

**MIDNR Great Lakes deepwater
Fisheries research theme assessment**

Shawn Sitar, Chairperson
Phil Schneeberger,
Randy Claramunt,
Jim Bence,
Ji He,
Chris Geddes

*Department of Natural Resources
Marquette Fisheries Research Station
484 Cherry Creek Road
Marquette, MI 49855*

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Three Research Priority areas for deepwater fish research:

1. **Improve field assessment of exploited deepwater species.**

Examples of study topics:

- Evaluation of creel surveys,
- Evaluation of aging techniques, procedures, and accuracy,
- Evaluation of survey designs and survey indices,
- Estimating hooking mortality,
- Assessing efficacy of stocked hatchery fish,
- Assessing population dynamics of lake whitefish.

2. **Population dynamics of deepwater fish species in the context of essential habitat, community and ecosystem processes.**

Examples of study topics:

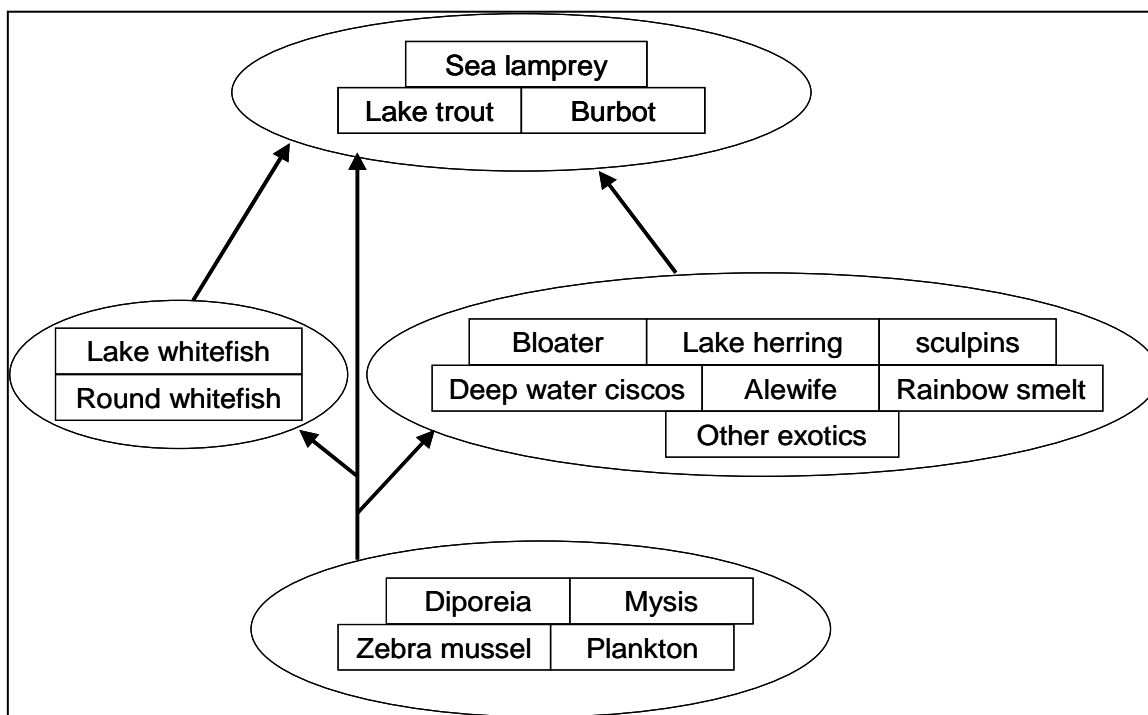
- Lake herring recovery,
- Conservation,
- Determining critical habitat,
- Assessing relationships between species,
- Quantify relationship between fish production and supply of spawning habitat.

3. **Better data syntheses and model predictions for achieving management goals.**

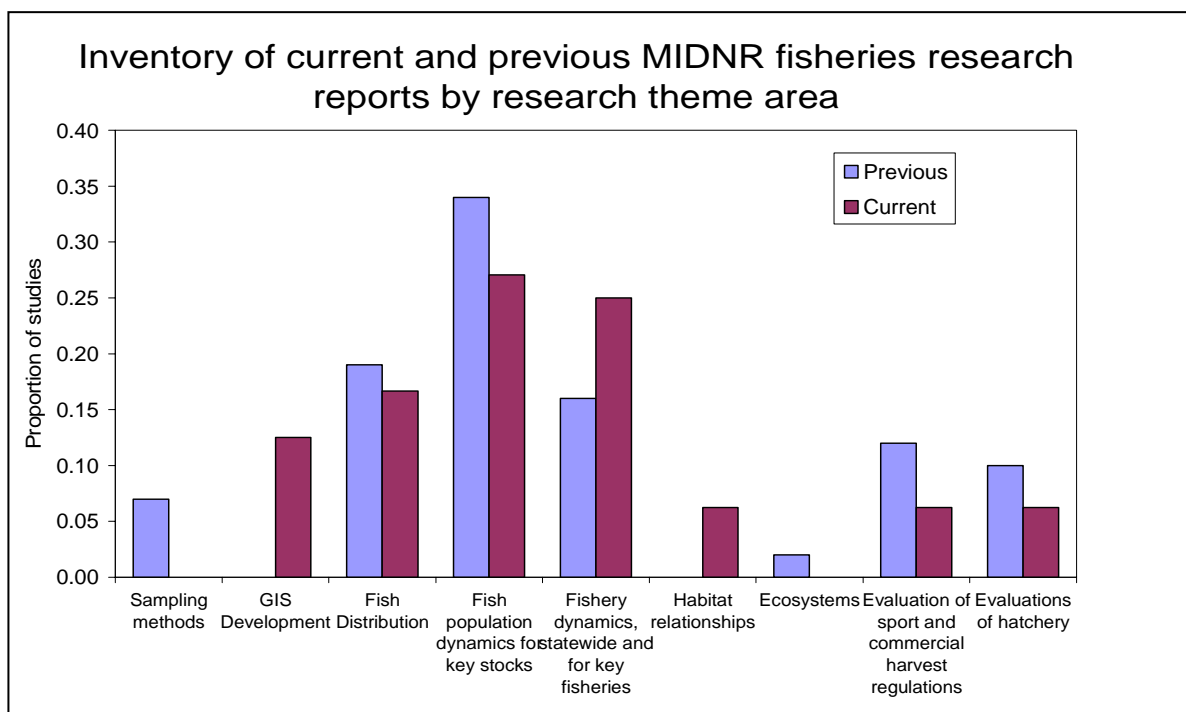
Examples of study topics:

- Harvest policy analysis
- Lake trout rehabilitation
- Evaluations of shifts in fishery behavior in response to management actions

Background—The deepwater fisheries encompass offshore areas including the following exploited species: lake trout, lake whitefish, lake herring, and deepwater ciscoes (bloaters, kiyi, shortjaw cisco). The major non-exploited fishes in the deepwater zones of the Great Lakes include: burbot, round whitefish, sculpins (slimy, deepwater, spoonhead), sticklebacks, rainbow smelt, alewife, and sea lamprey. Most of the non-exploited fishes serve as forage for exploited piscivores. Lake trout continues to be the central focus of Great Lakes deepwater fisheries research. In Lake Superior, lake trout have mostly recovered to historic levels, however in Lakes Michigan and Huron, populations continued to be sustained by stocking of hatchery fish. There is current interest in the recovery of lake herring in the lower Great Lakes.



Review of past research (topic and approach)—Based on reviewing MIDNR Fisheries Research Reports, most of the past research topics in deepwater fisheries has focused on population dynamics and fishery harvest dynamics (commercial and more recently, recreational). Many of the studies focused on lake trout and lake whitefish. The past approaches emphasized field sampling and fishery statistics centered on field survey data. There were very few modeling and organism-level studies. Most of the approaches were based on traditional measures of patterns in harvest, fishery CPUE, mortality, survey relative abundance indices, and growth. Habitat relationships and GIS were not research areas in the past.



Summary of current deepwater zone research—Current research projects continue to be primarily focused on population dynamics and fishery harvest dynamics. Compared to past studies, there has been a decline in the proportion of research studies focused on sampling methods evaluation, harvest regulations, and hatchery evaluations. However, the research areas have started to diversify into non-traditional areas such as human dimensions, GIS, genetics, and modeling. Lake trout and lake whitefish continue to be the primary species studied in the deepwater zones of the Great Lakes.

Other agencies on the Great Lakes are currently involved in prey fish surveys and ecosystem-level research such as food-web analysis. Some work has been done on physical habitat mapping for lake trout spawning reefs using acoustic technology.

Current MIDNR fisheries research studies related to deepwater fishes

Study #	Title	Research areas
427	Measurement of sportfishing harvest in lakes Michigan, Huron, Erie, and Superior	Sampling, Fishery dynamics, Evaluation of sport and commercial harvest regulations
451	Evaluation of lake trout stocks in Lake Huron	Sampling, Fish population dynamics, Fishery dynamics, Evaluation of sport and commercial harvest regulations
462	Charter boat catch and effort from Michigan waters of the Great Lakes	Sampling, Fishery dynamics, Evaluation of sport and commercial harvest regulations
465	Assessment of lake whitefish populations in Lake Superior	Sampling, Fish population dynamics, Fishery dynamics, Evaluation of sport and commercial harvest regulations
486	Assessment of lake trout populations in Lake Michigan	Sampling, Fish population dynamics, Fishery dynamics, Evaluation of sport and commercial harvest regulations
489	Comparison of mail and creel survey estimates for recreational fishing on the Great Lakes	Sampling, Fishery dynamics, Evaluation of sport and commercial harvest regulations
495	Assessment of lake trout populations in Lake Superior	Sampling, Fish population dynamics, Fishery dynamics, Evaluation of sport and commercial harvest regulations
508	A profile of Michigan anglers; preferences, market segments and expenditures	Fishery dynamics
713	Improving fishery stock assessments in the Great Lakes	Sampling, Fish population dynamics, Fishery dynamics, Evaluation of sport and commercial harvest regulations
724	The importance of trophic interactions for salmonine fisheries of the Great Lakes	Fish population dynamics, Fishery dynamics, Ecosystems

Research needs (MIDNR, GLFC)—Since lake trout recovery is still a major state and international goal, new scientific questions have been developed. Research priorities for lake trout recommended by the Great Lakes Fishery Commission technical committees are focused on improving our understanding of the bottlenecks of successful natural reproduction (the process from spawning stock to recruitment). This involves expanding our knowledge on the early life survival of lake trout (egg, fry, juvenile), including quantitative evaluations of hatchery lake trout and their performance in the lakes. Furthermore, the impacts on lake trout recovery from non-native species is apparent and needs to be further assessed.

Related to lake trout recovery is the recovery of lake herring. Lake herring is a native forage fish for lake trout, and is an eminent research topic in the lower Great Lakes. There is strong interest in conducting basic stock assessments and reintroduction programs for lake herring in the upper Great Lakes. Therefore, basic and innovative research approaches need to be developed to understand lake herring population dynamics and provide effective management support for their recovery.

Although lake whitefish is the major commercial fish in Michigan waters, the amount and scope of research on this species has been limited. There is interest in continuing and expanding the quantitative assessment modeling on lake whitefish, but also to improve our understanding the causes and effects of recent declines in growth and health profiles. Some of this is related to changes in the food-web and impacts from non-native species such as zebra mussels.

Physical habitat that is important for fish production needs to be quantified. Very little has been done to inventory the physical habitat for deepwater fishes. The linkage between the quantity and quality of important habitats for deepwater fish production needs to be evaluated. For example, knowing the quantity of various qualities of spawning substrate for lake trout will help managers understand the production limitations of a stock. Furthermore, habitat supply modeling can help stock assessment models establish reasonable maximum bounds around the biological production of a stock.

Current Fish Division areas of emphasis pertinent to deepwater fish research

Area of Emphasis	Related research objective/task
Commercial fisheries	Establish stock assessment monitoring standards for lake whitefish
Fish production	Conduct fish culture research and experiments; conduct research into fish health and product quality
Recreational fisheries	Market and economic analysis
Resource management	Harvest estimation and evaluate sport fish regulations

Current Great Lakes Fishery Commission research priorities relating to deepwater fishes:

Research area	Specific research needs
Lake trout rehabilitation	population dynamics, stock delineation
	bottlenecks from spawning stock to recruitment
	early life survival of hatchery fish
	impacts of exotics (alewife-EMS; gobies; sea lampreys)
Lake whitefish	population dynamics, stock delineation, recruitment
	recent health issues
	growth, diet, bioenergetics, effects of food web changes (exotics)
Habitat	inventory and quantify habitat: bathy-thermal, spawning, nursery, etc.
	analyze relationship to fish production (abiotic to biotic layers)
Prey fish (with emphasis on lake herring recovery)	population dynamics, basic biology
	biomass estimates; developing and evaluating techniques: acoustics, biomass size spectrum models
	interactions of exotics with native prey fishes
	reintroduction into lower Great Lakes
Sea lamprey	interactions with species other than lake trout
	improving mortality estimates
	review of sea lamprey control process and options
Lower trophic level	what is the status of invertebrates important to fishes of concern in deepwater zone (e.g., diporeia, Mysis, zooplankton)